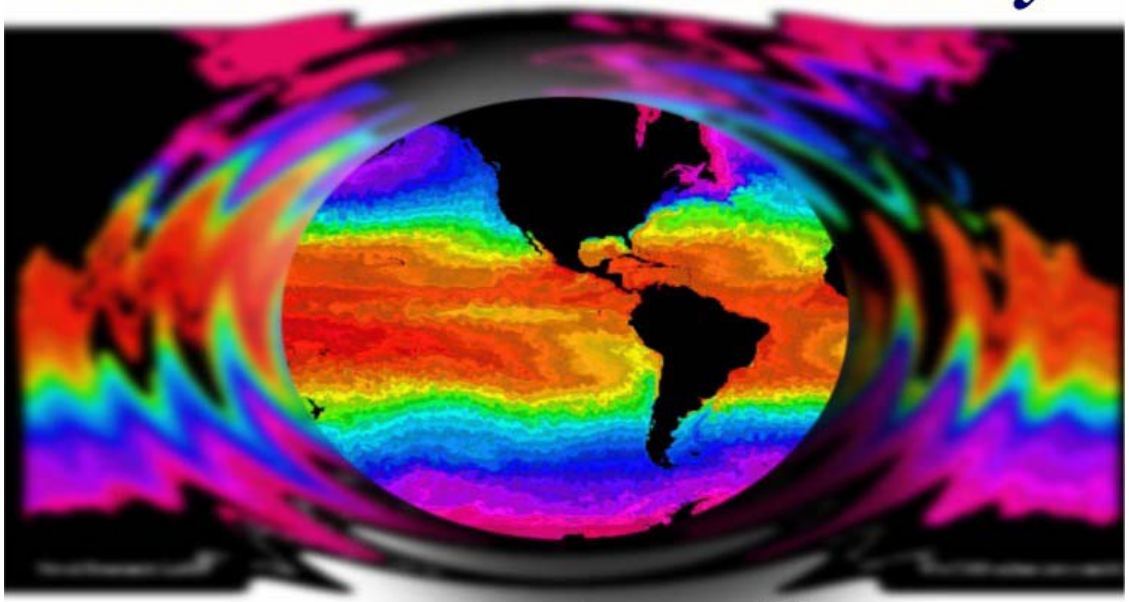
Naval Research Laboratory



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http://www.ocean.nrlssc.navy.mil

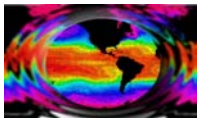
Ocean Prediction Capabilities (Present & Future) at the Naval Research Laboratory

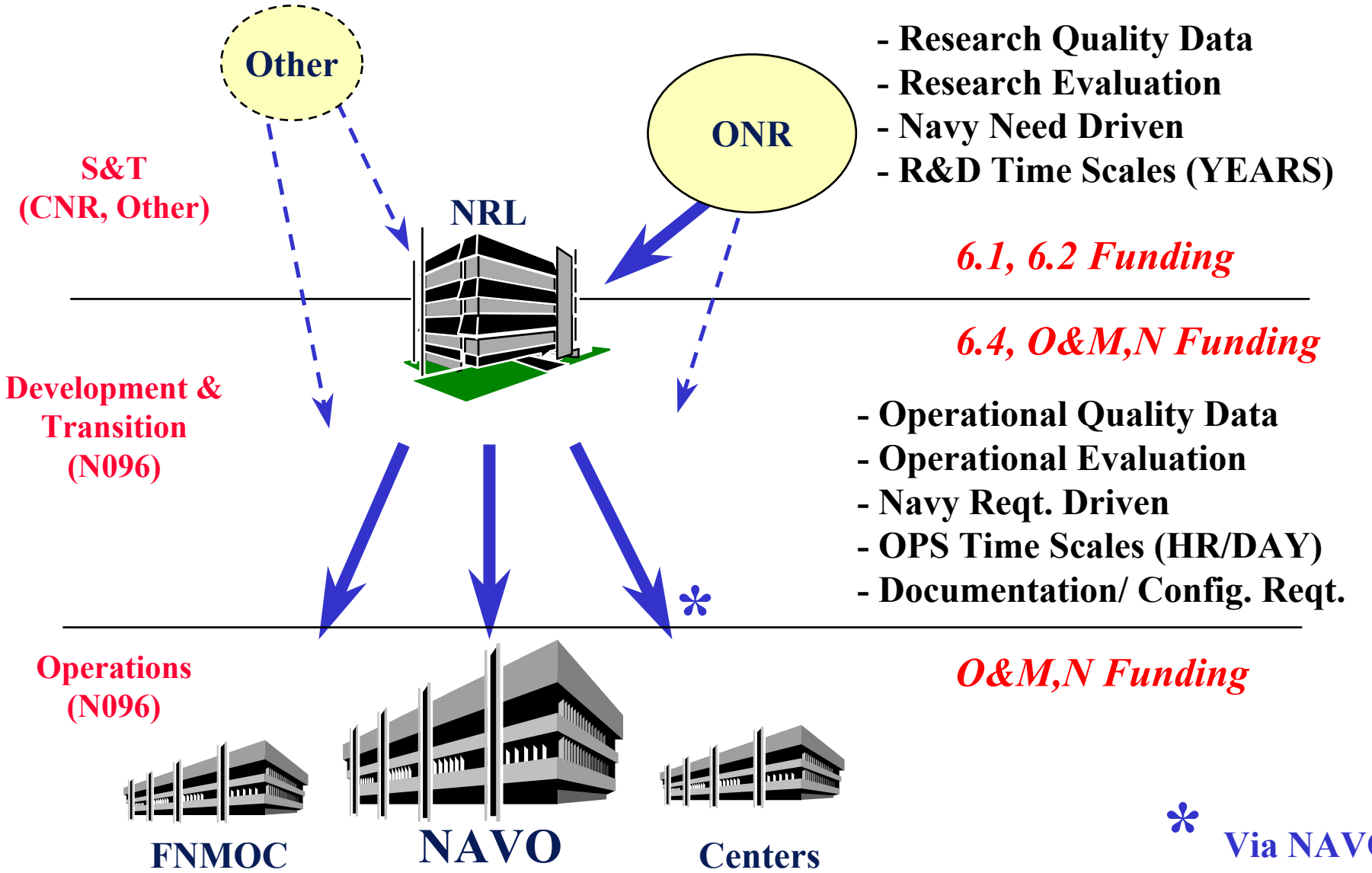
J. Harding[1], R. Preller, R. Rhodes

Presented at: MTS/IEEE OCEANS 2002, October 2002

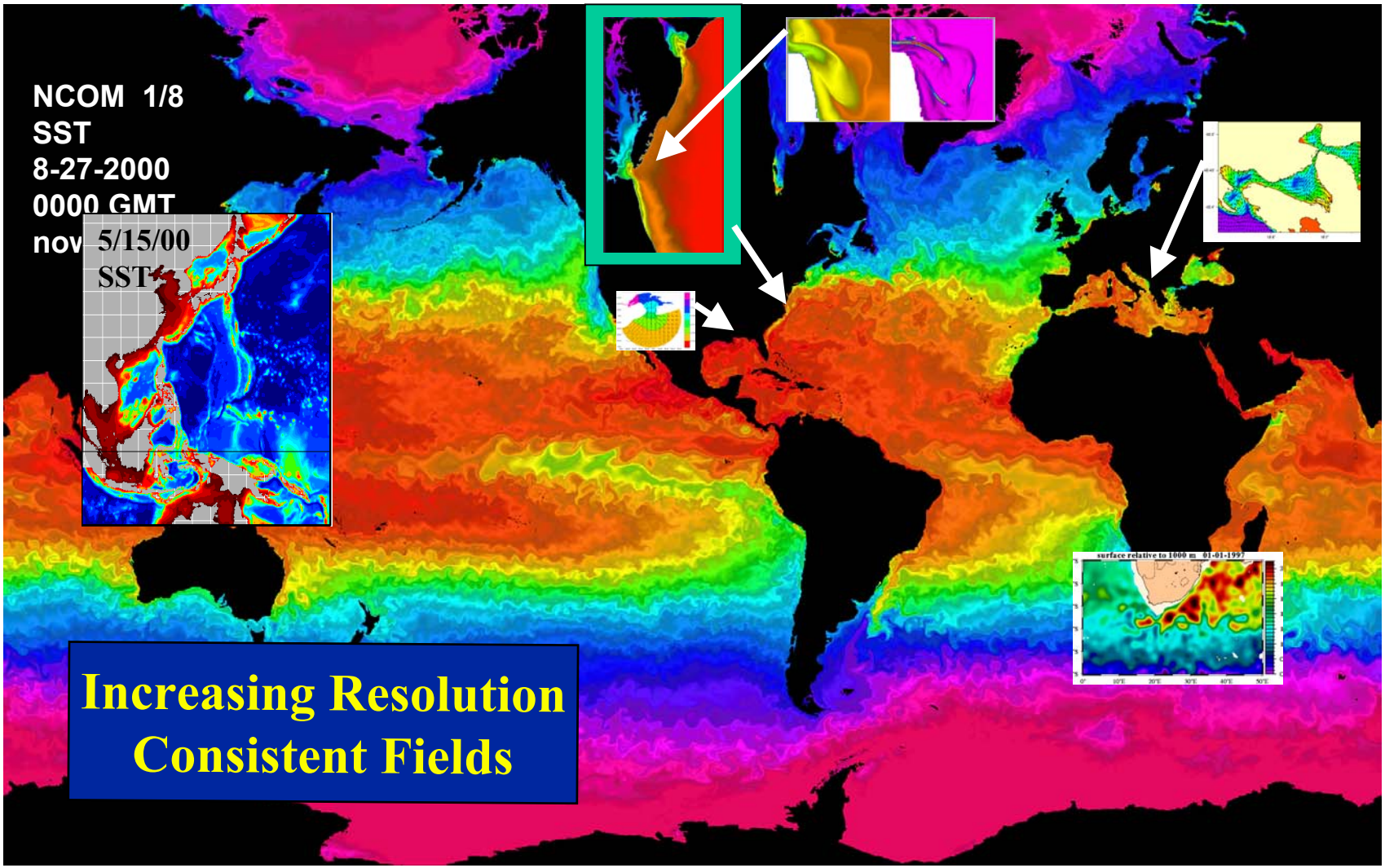
[1]Present Affiliation: Naval Oceanographic Office

Ocean Funding/Transition Interaction



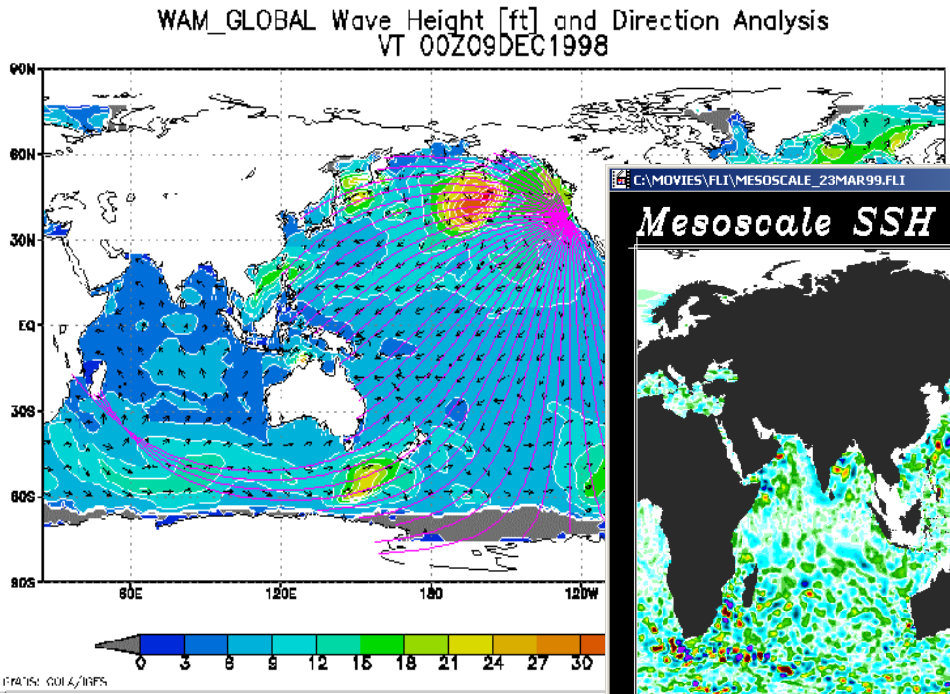


Global to Littoral Nested Strategy

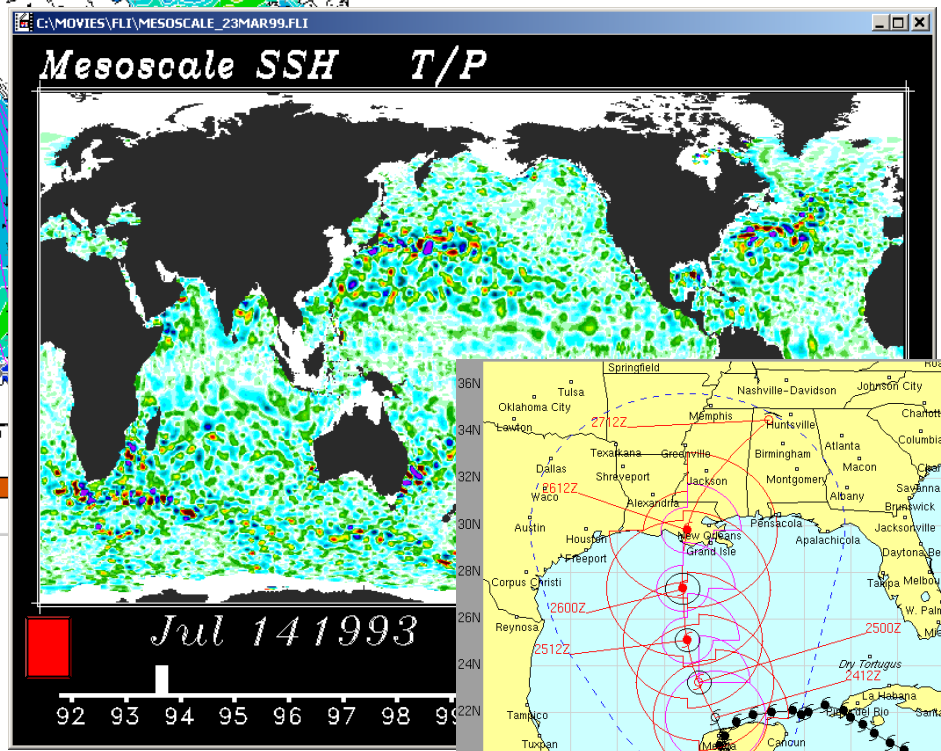


Importance of Global View in Littoral Ocean Prediction

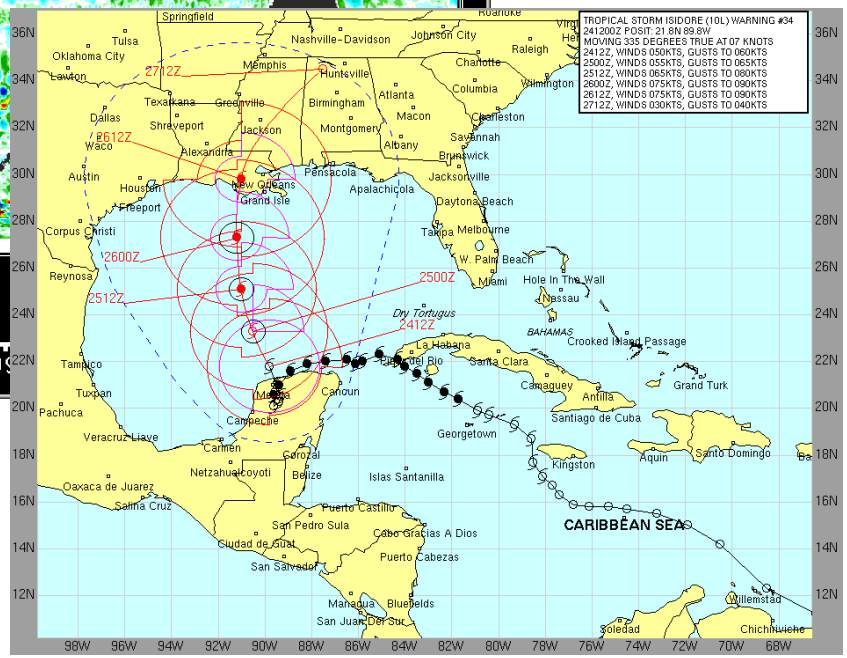
Surface Swell Propagation Example



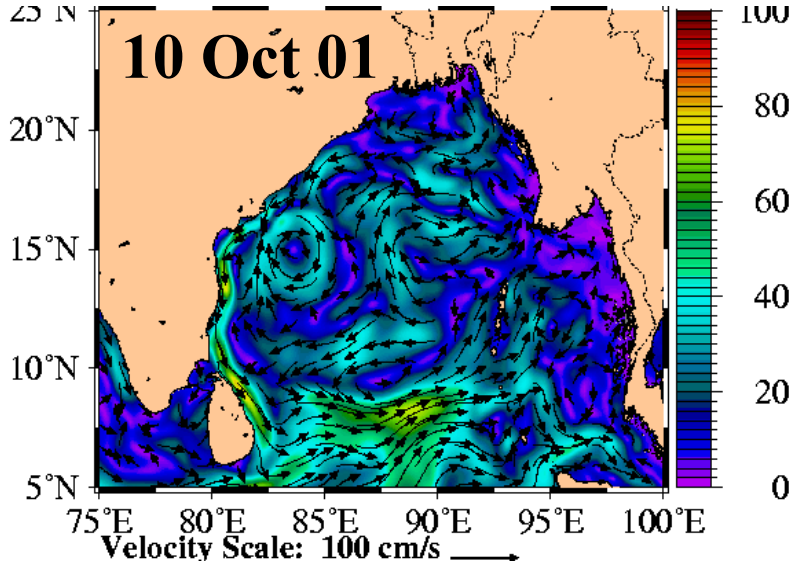
Mesoscale Dynamics Example

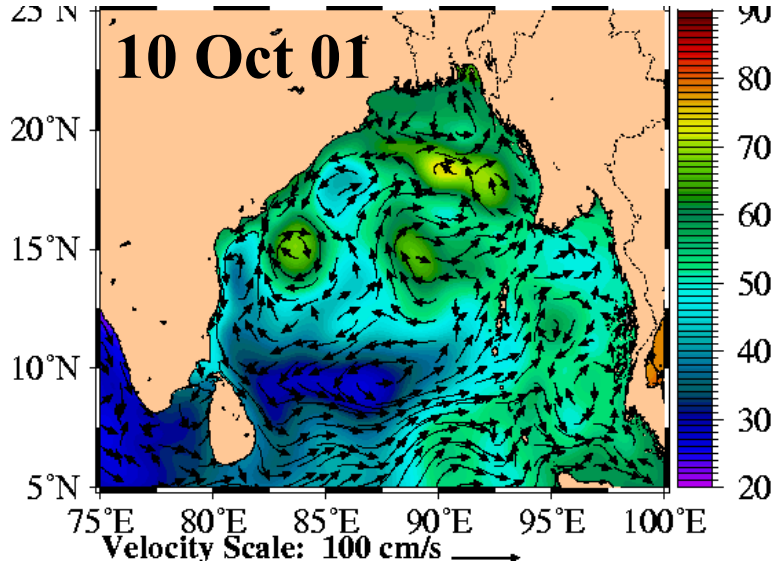


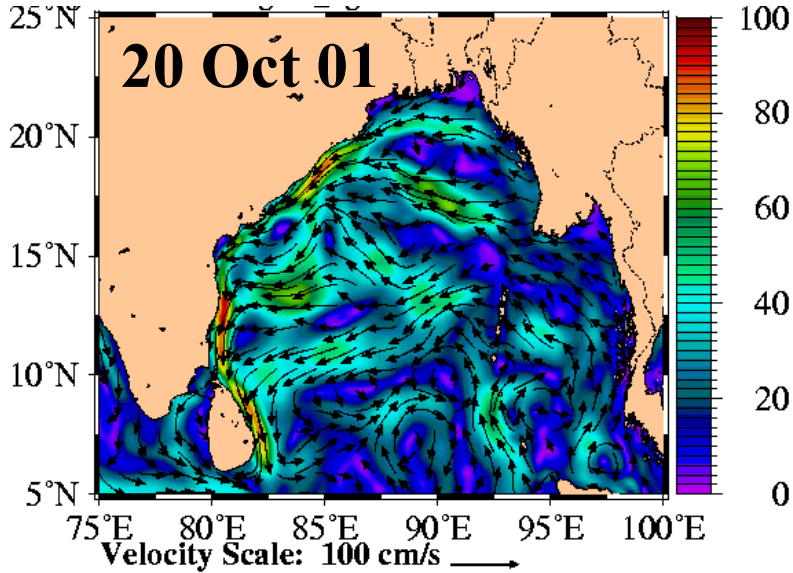
Storm Surge Example

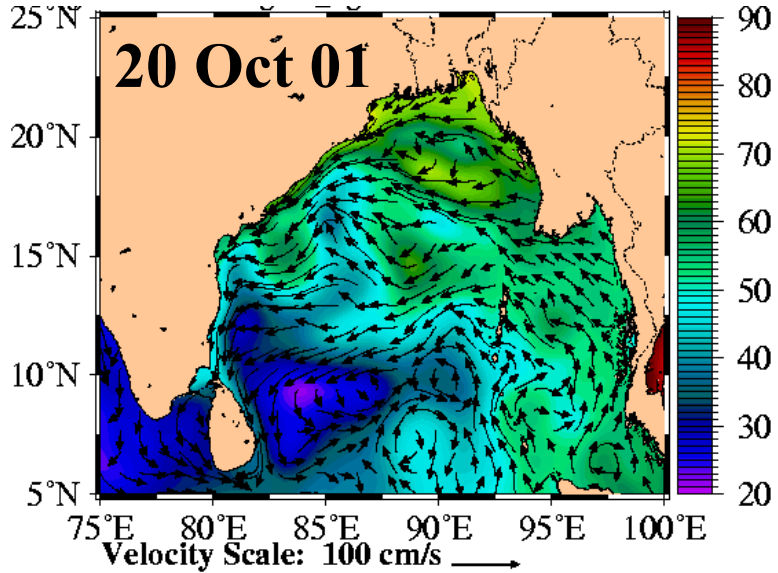


Importance of Global View in Littoral Ocean Prediction

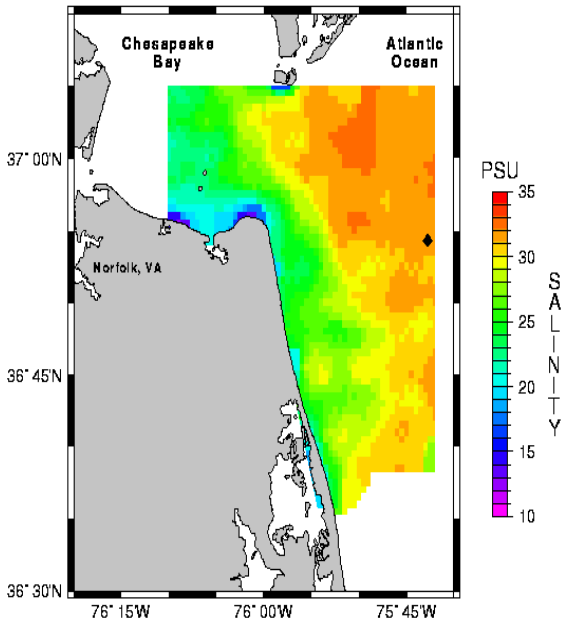




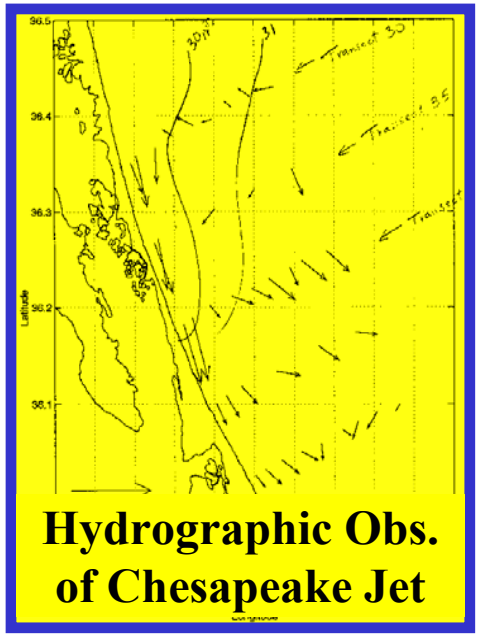




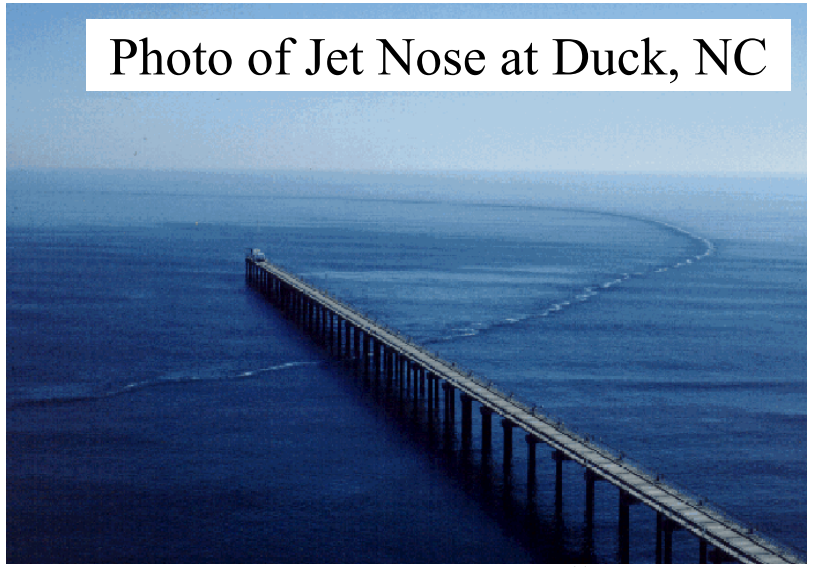
Importance of Non-Local View in Littoral Ocean Prediction



NRL 7300 Salinity Mapper Observations of Chesapeake Jet



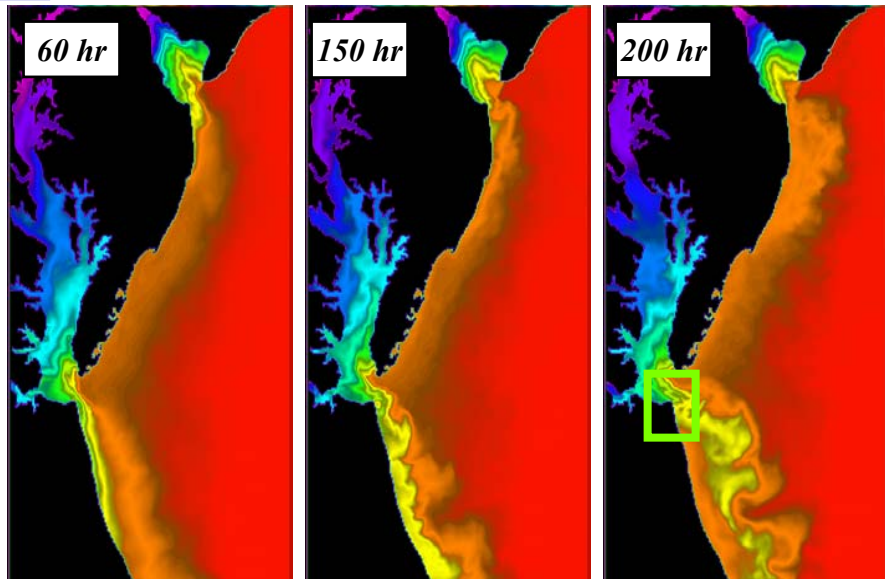
Hydrographic Obs. of Chesapeake Jet



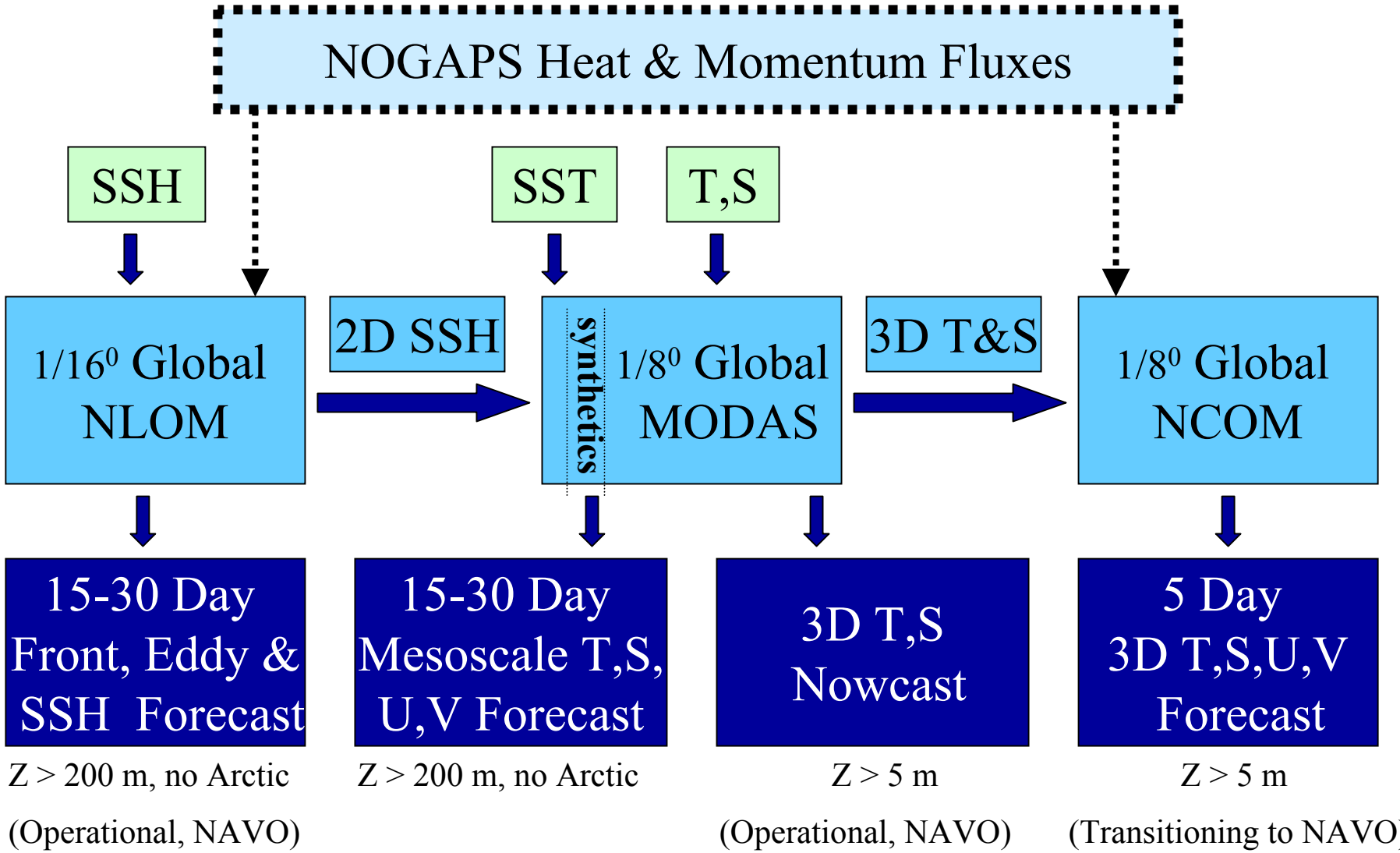
Courtesy Jerry Miller, NRL 7300

NCOM Simulation of Chesapeake Jet

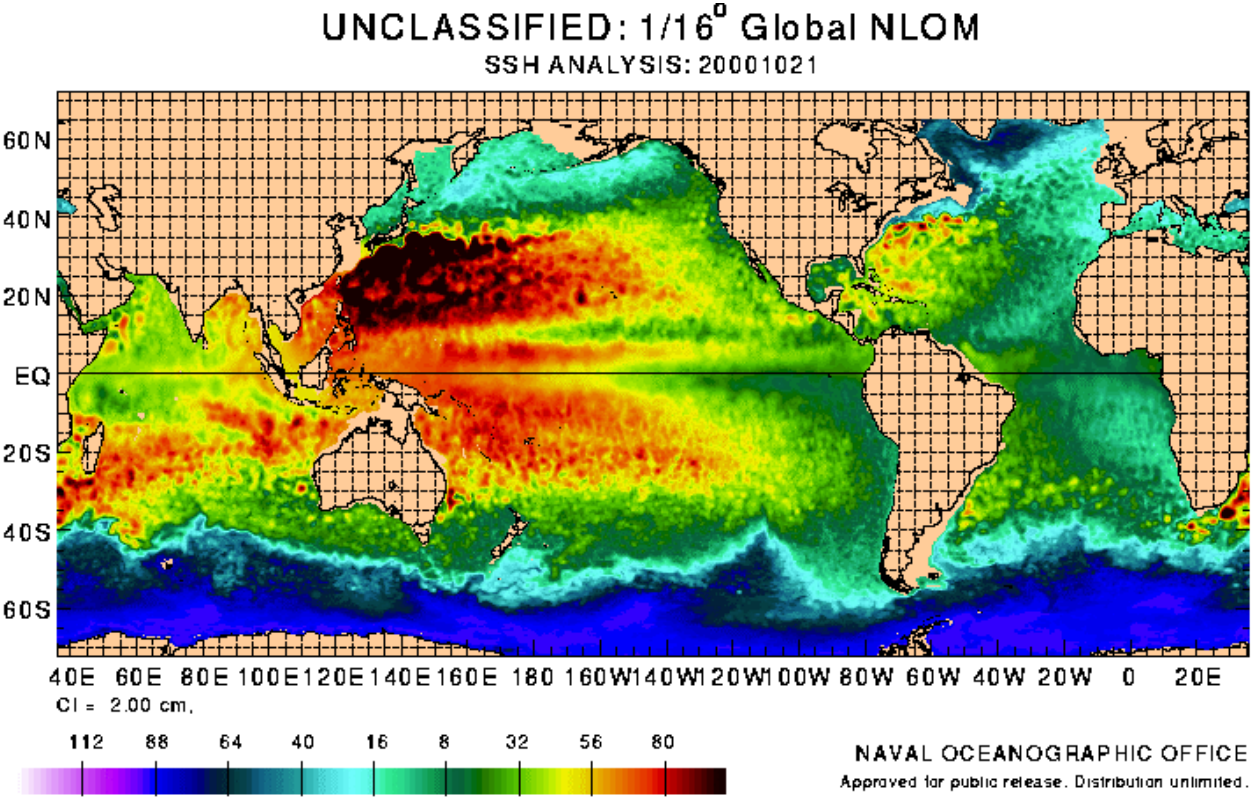
(Mean river flow; 8 tides; 10-day winds; 1km)



Global Ocean Prediction Baseline



Navy Layered Ocean Model (NLOM)

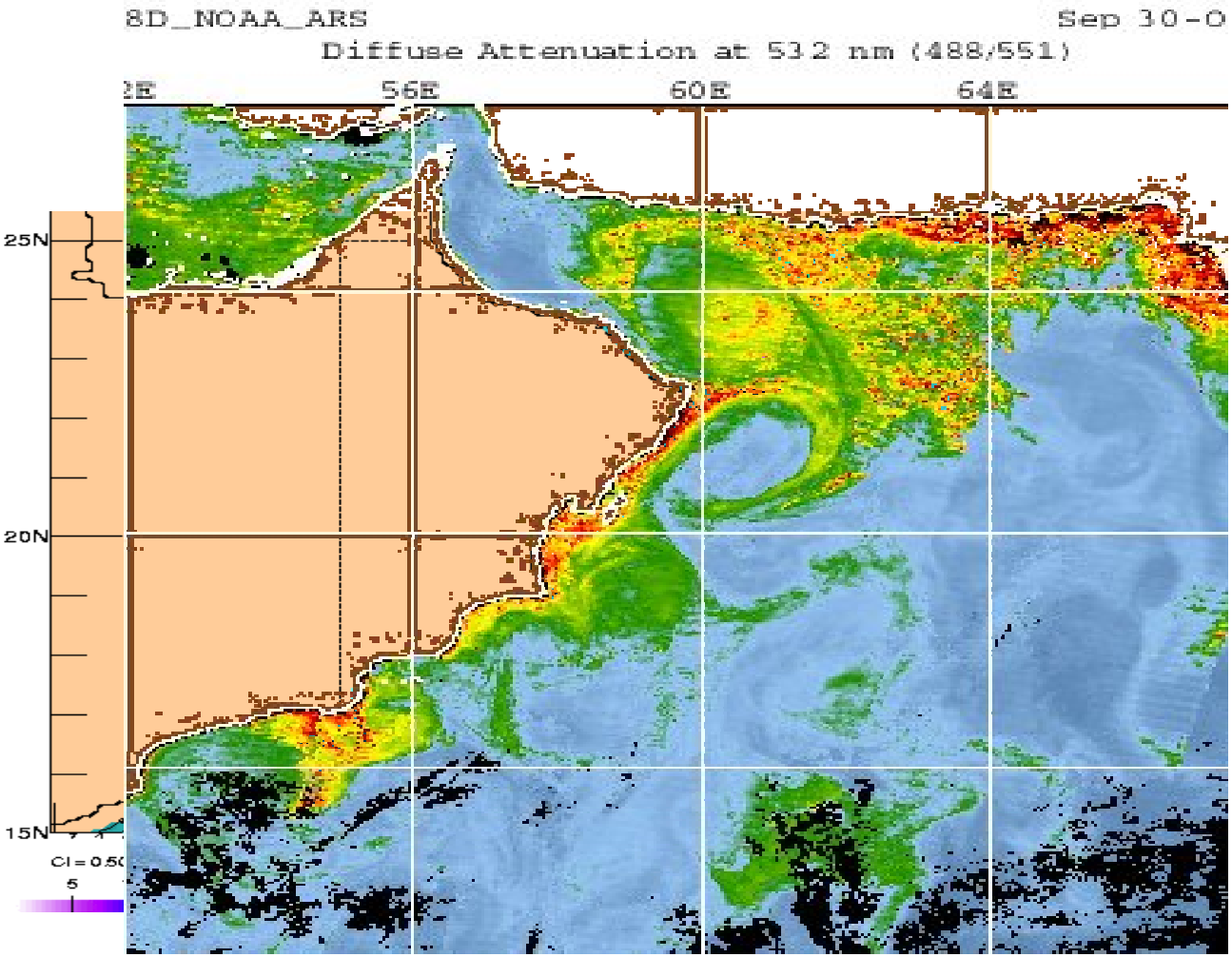


- *NRL global primitive equation ocean circulation model*
- *6 active layers*
- *Forced by real-time NOGAPS surface heat fluxes and wind stresses*
- *Assimilates satellite altimetry data and MODAS SST analysis*
- *Provides SSH and Front & Eddy forecast capability*

http://www.ocean.nrlssc.navy.mil/global_nlom

Global NLOM Relative to SeaWIFS

Arabian Sea



Global NLOM :

Oct 3 2002

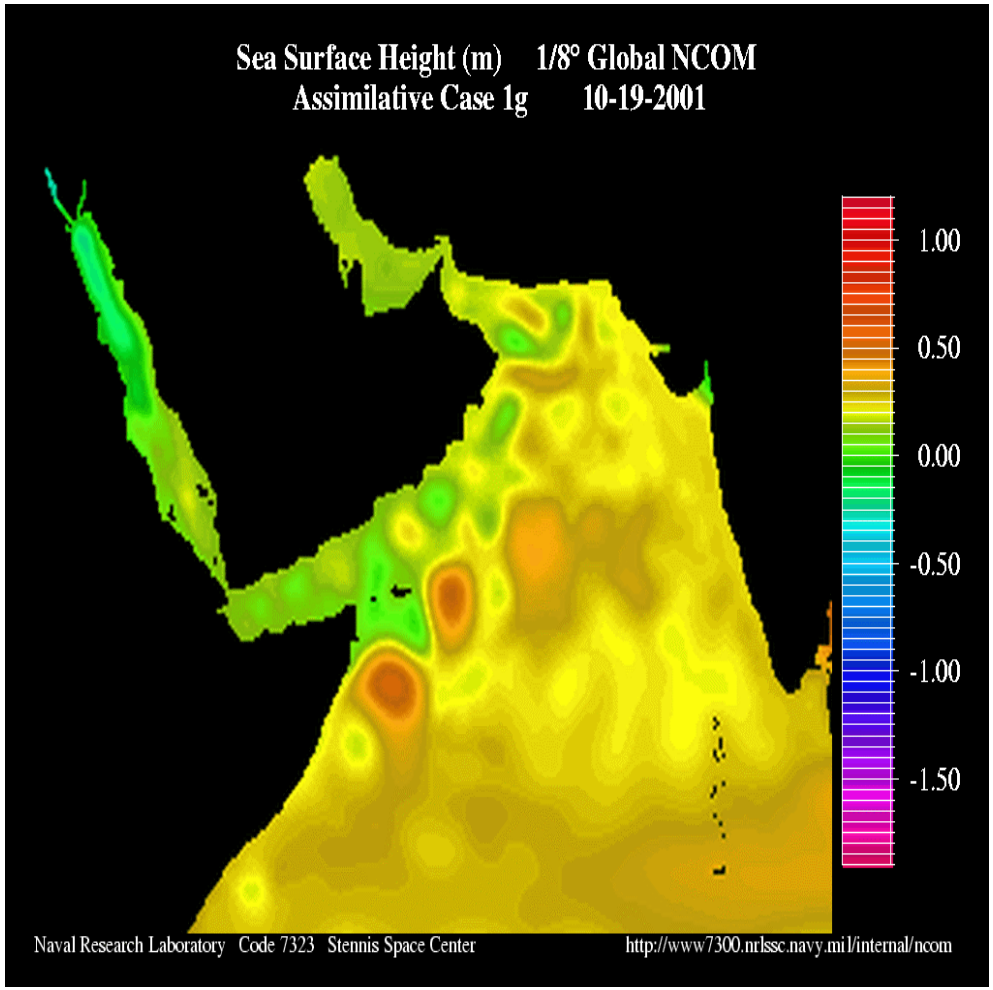
SeaWIFS:

Sep 30-Oct 7

2002

Navy Coastal Ocean Model (NCOM)

(Princeton Ocean Model (POM) family derivative)



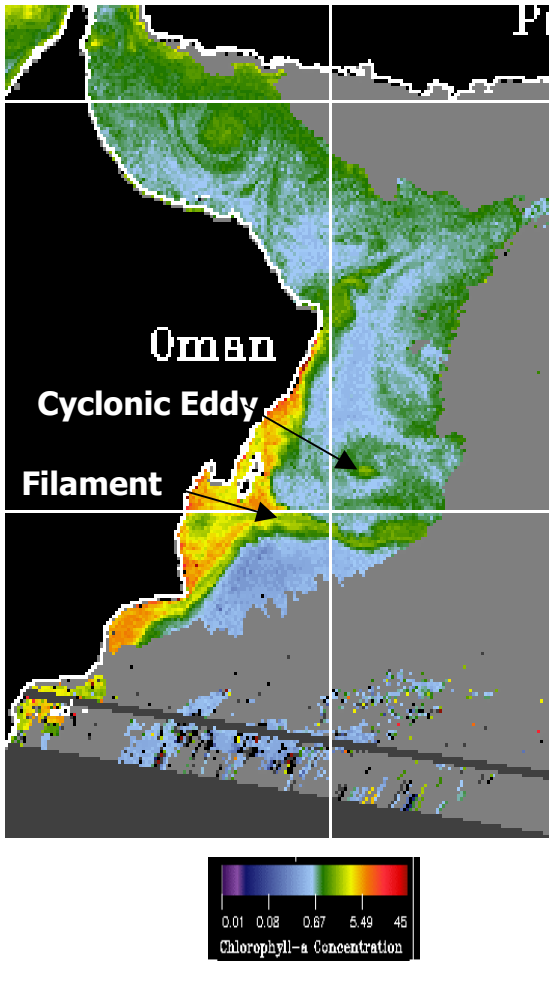
- *POM-type codes in wide use around the world for coastal & harbor applications*
- *Full primitive equation ocean circulation model*
- *Sigma/Z level hybrid coordinate in vertical*
- *Includes river runoff, tidal forcing, and tracer capability*
- *NCOM both global and integrated into COAMPS*
- *Efficient scalable, portable code (Wallcraft, Martin)*

http://www.ocean.nrlssc.navy.mil/global_ncom

SeaWIFS relative to NLOM/NCOM

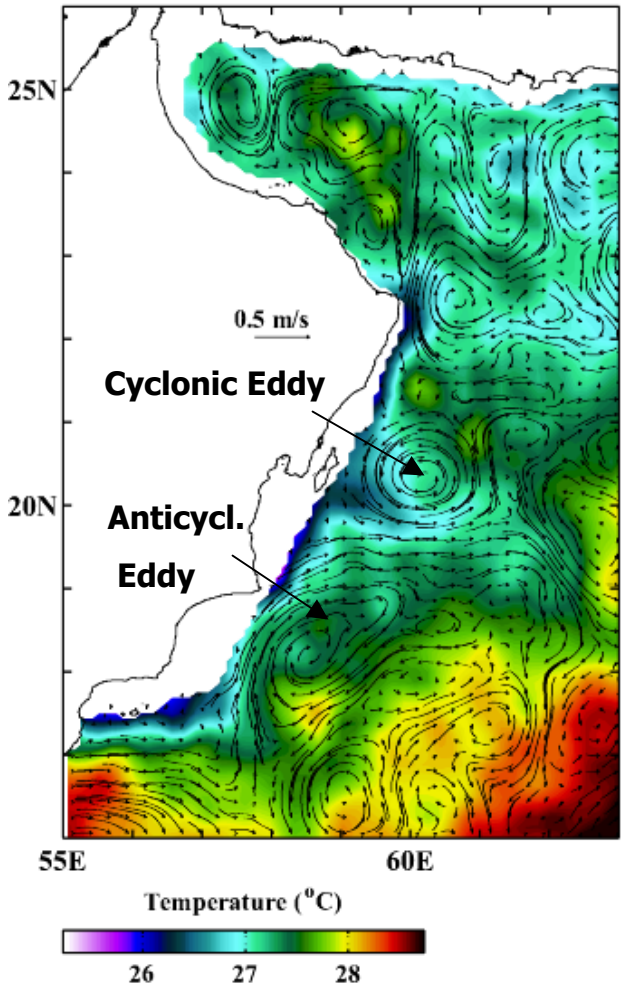
Oman Coastal Filaments

SeaWIFS: 19 Apr. 01

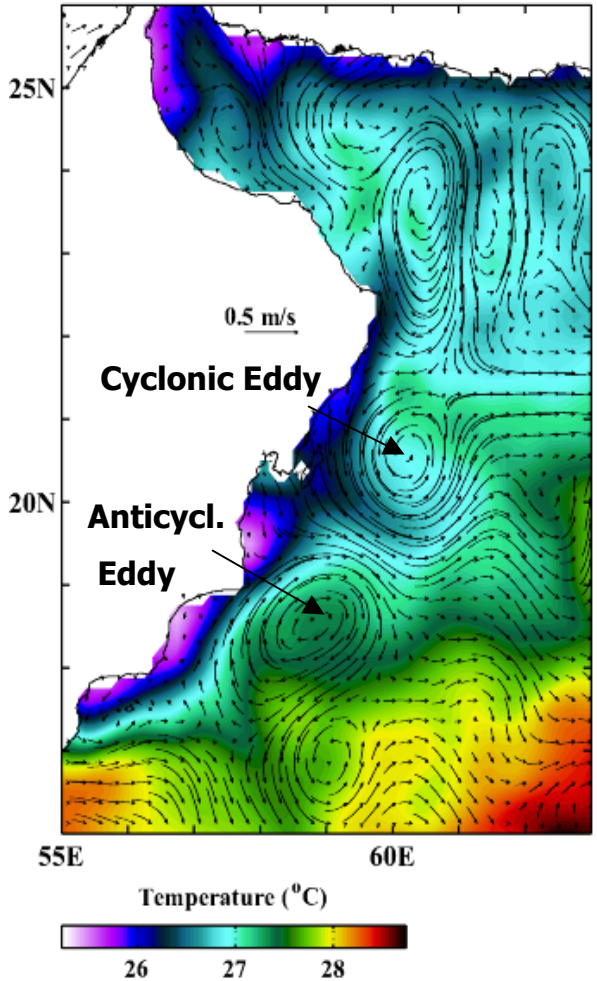


Chlorophyl from SeaWIFS

NLOM: 19 Apr. 2001



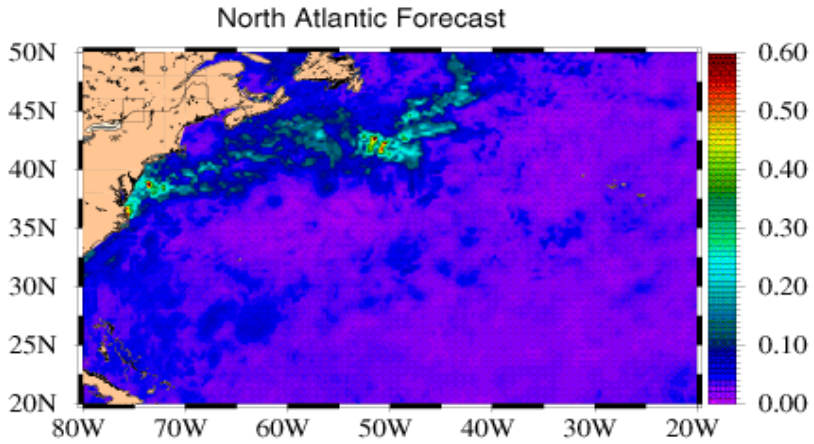
NCOM: 19 Apr. 2001

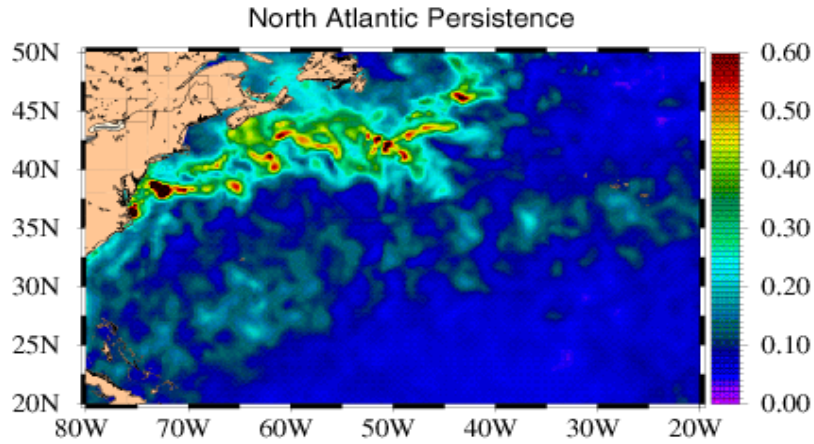


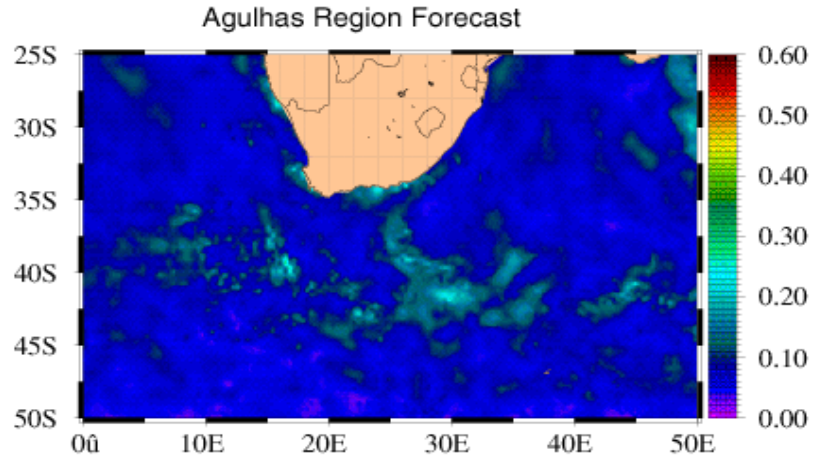
Model SST and Surface Currents

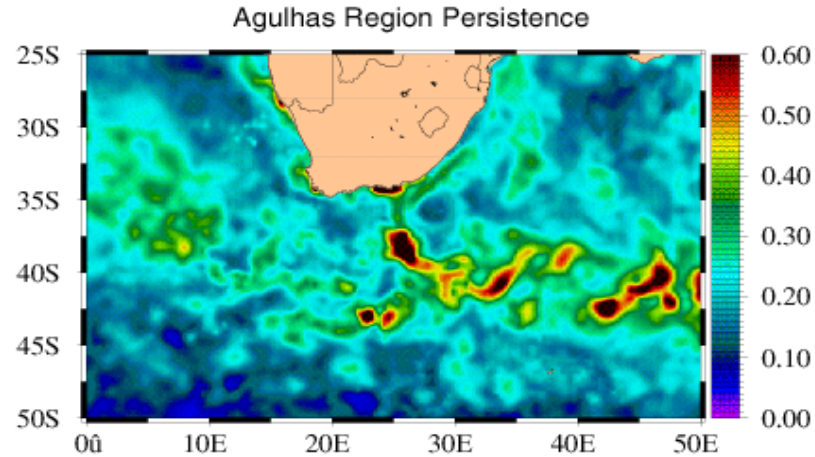
NCOM Forecast Skill

SST – 48 hr. Forecast Verification









2 Day SST Forecast Verification Statistics

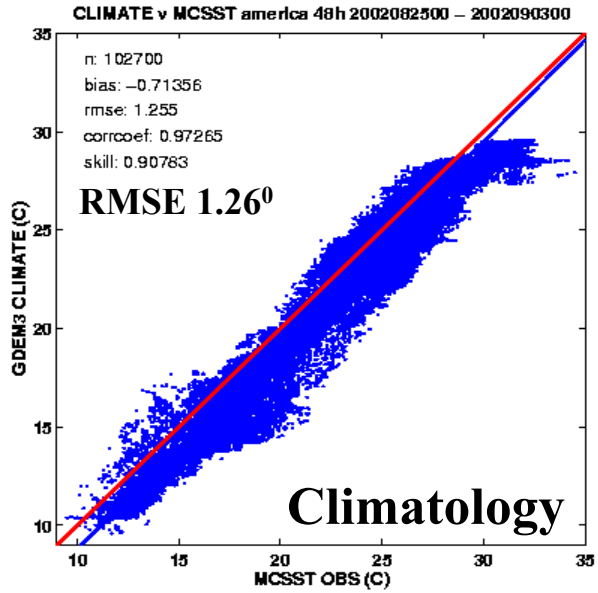
Mean RMS (^{0}C) over 40 forecasts made 4 Jan 2001 – 12 Feb 2001

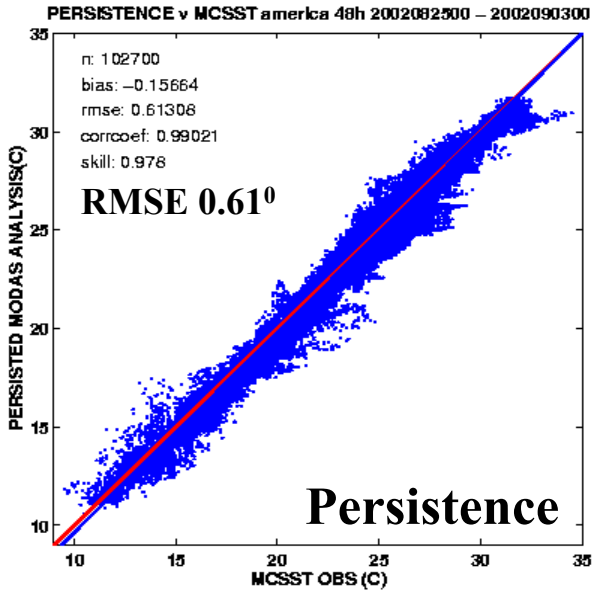
NCOM relative to Existing Products

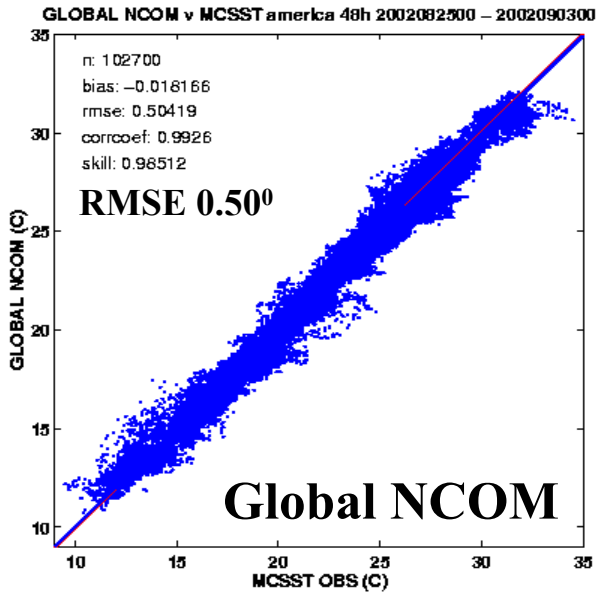
SST – 48 hr. Forecast Verification

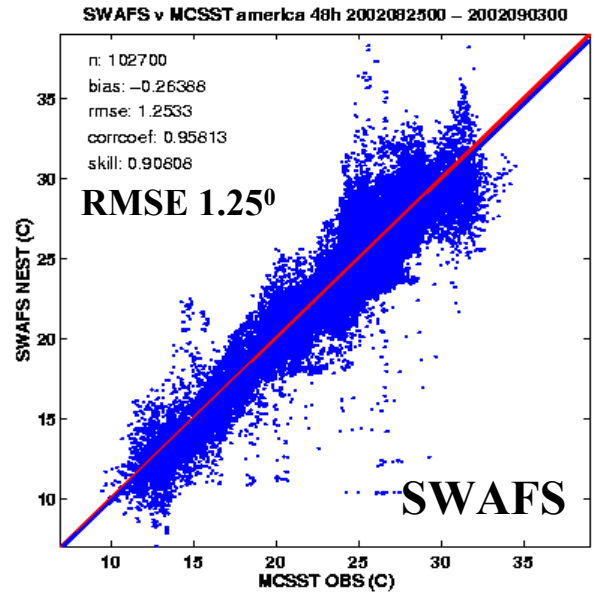
Scatter plot Comparisons of MCSST obs. vs. Analysis or Model SST products for Tau 48 ("SWAFS Americas" domain.)

Example of metric software put together by Clark Rowley to monitor daily performance of various real-time products.



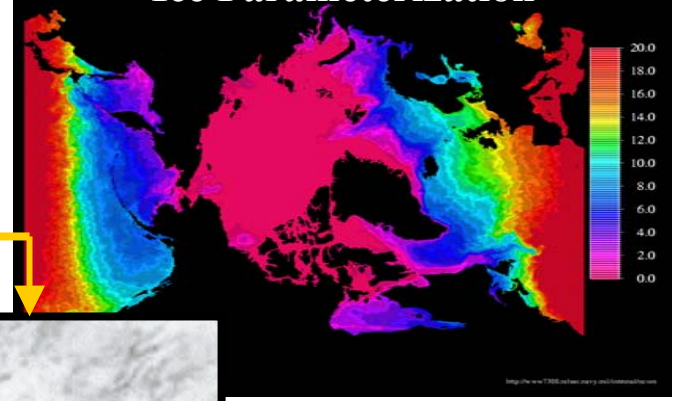






Polar Ice Prediction System 3.0

Example of Current NCOM Ice Parameterization



Forecast Restart (ice-ocean) or Ocean Analysis/ SSMI Ice Concentration and Satellite Ice Drift

Atmospheric Forcing NOGAPS

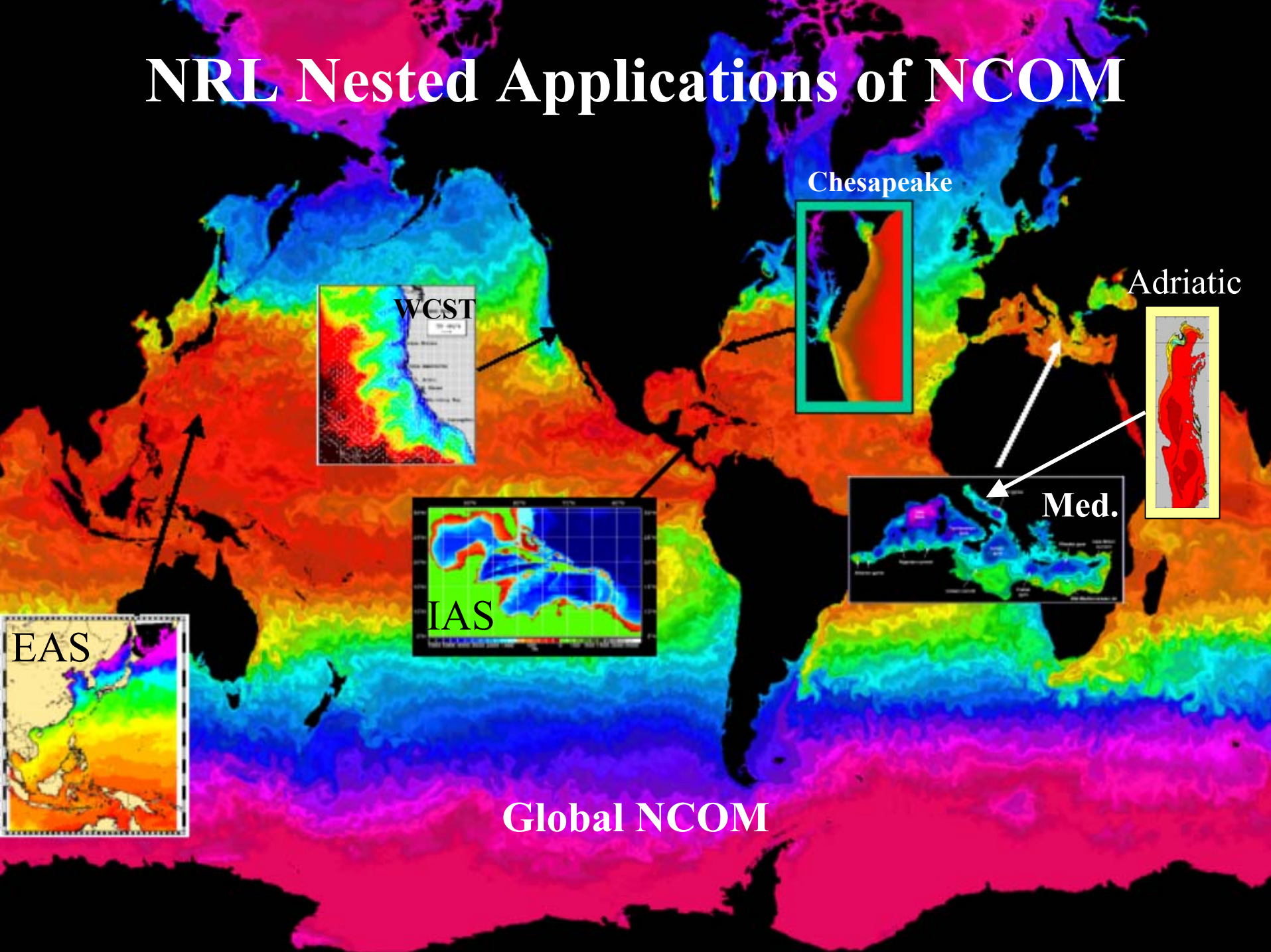
Global Ocean Model (NCOM)

LANL CICE Model

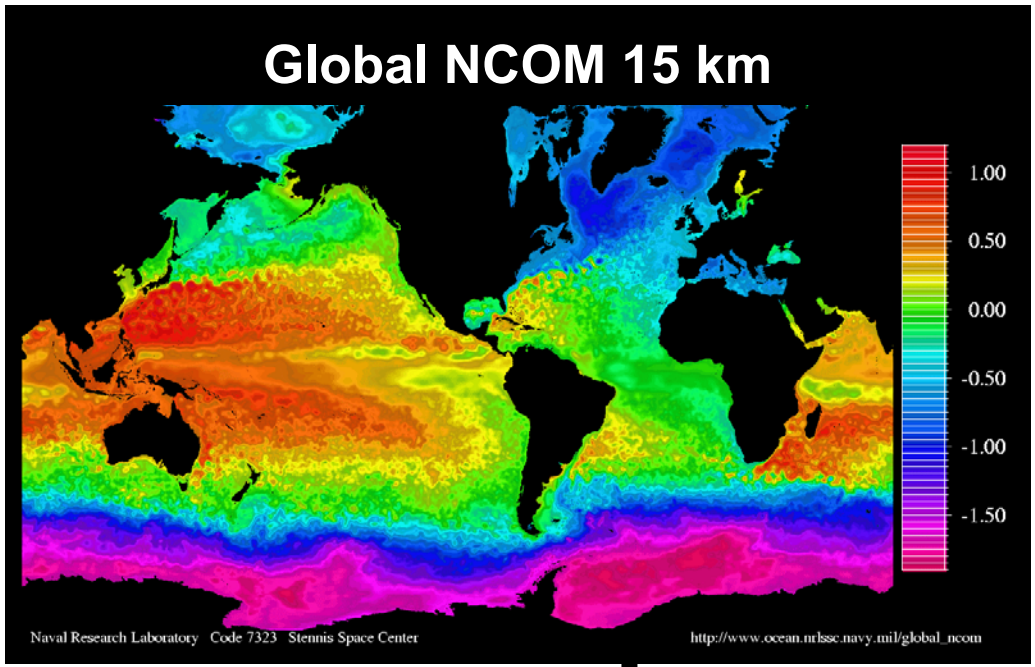
24-hour Forecast for Ice-Ocean Restart

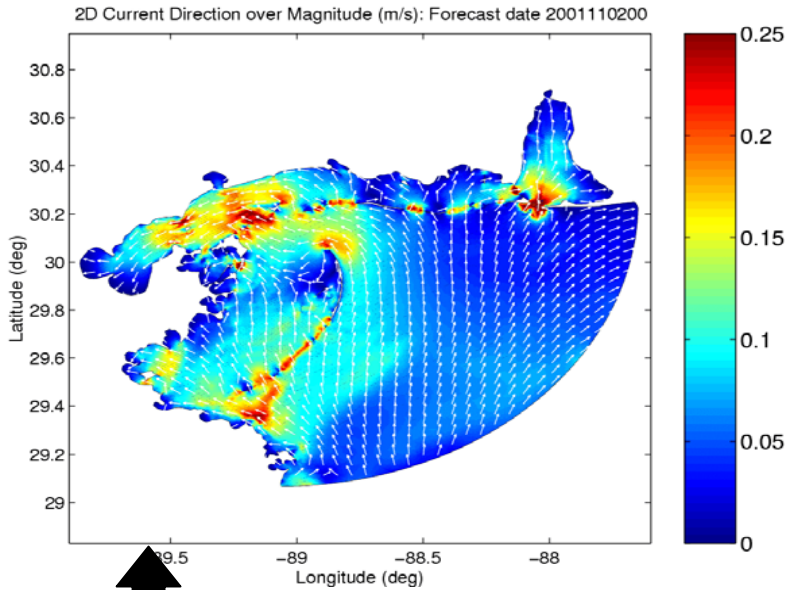
Model Output
- Ice Drift
- Ice Thickness
- Ice Concentration
- Ice conv/div
- Ice strength
- Ocean Currents
- Ocean Temps
- Ocean Salinity

NRL Nested Applications of NCOM



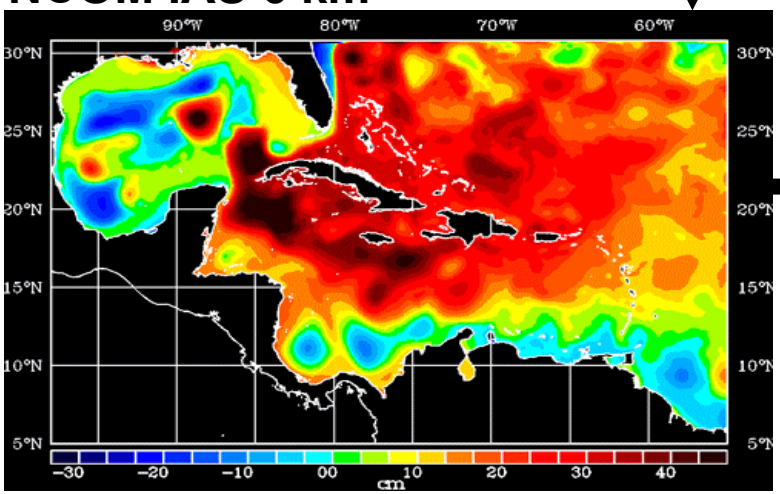
Model Nesting Example: Littoral Focus in Gulf of Mexico

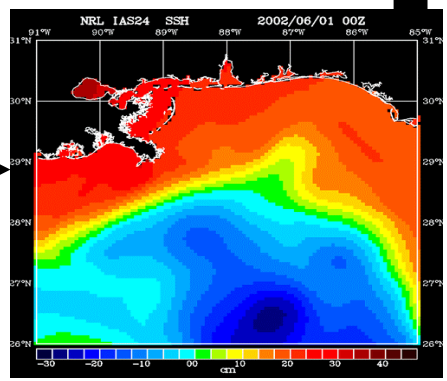




ADCIRC MS Bight
1 km – 100 m.
(Alternative to 100 m NCOM/ECOM/Delft3D)

NCOM IAS 6 km

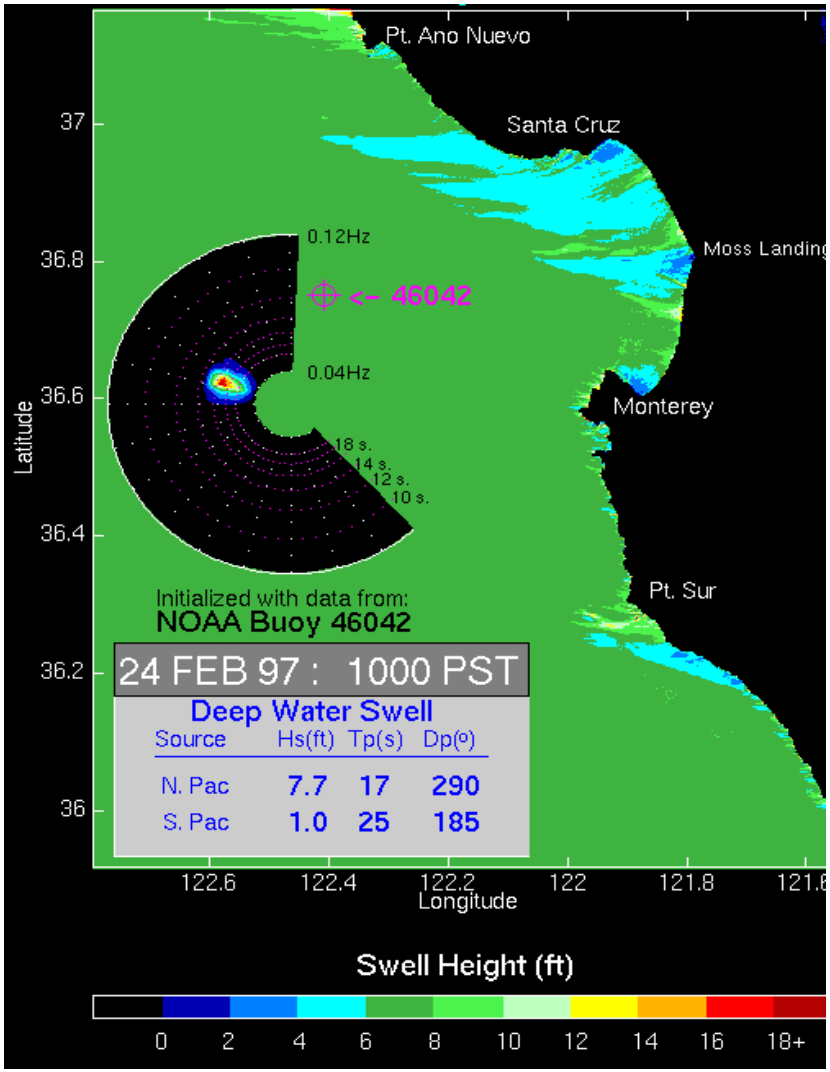




NCOM NGulf 2 km

Wave Model Nesting

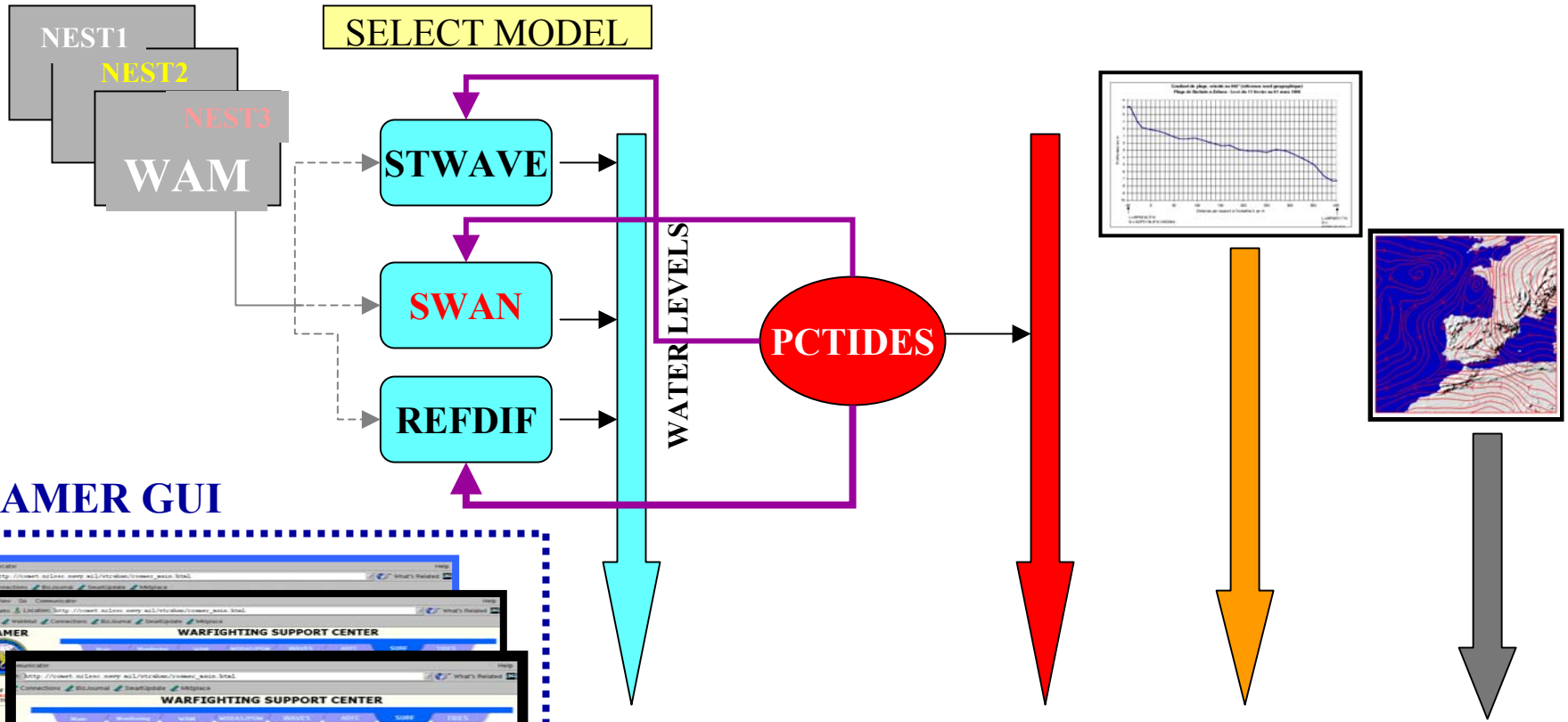
ROAMER – IOPS - DIOPS



- ***WAM physics valid only for water depths greater than 30 m***
- ***However, WAM can provide open boundary condition (i.e., incoming swell) forecasts for shallow water models such as REFDIF, STWAVE or SWAN wave transformation and NSSM surf models***
- ***Shallow water models require very high-resolution representation of bathymetry***

ROAMER – IOPS Framework

DEEP-WATER SPECTRA | SHALLOW-WATER SPECTRA | TIDES | BEACH PROFILES | WINDS



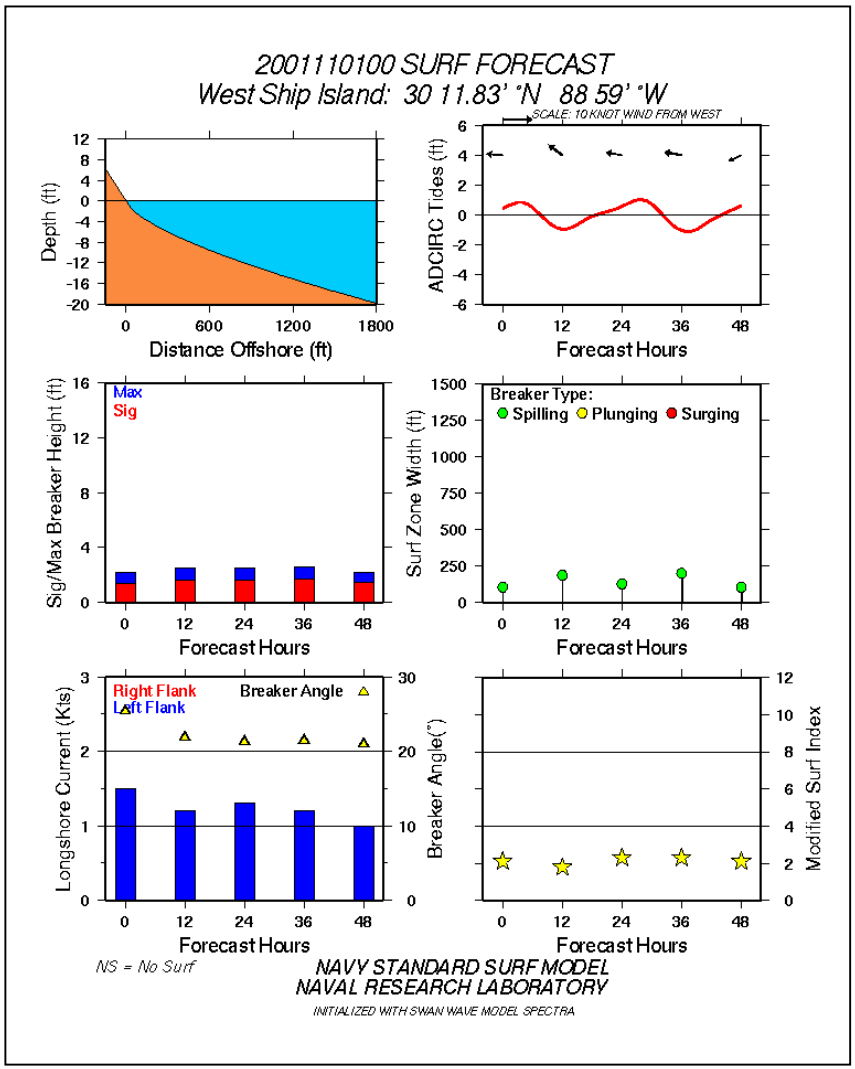
ROAMER GUI

SURF MODEL

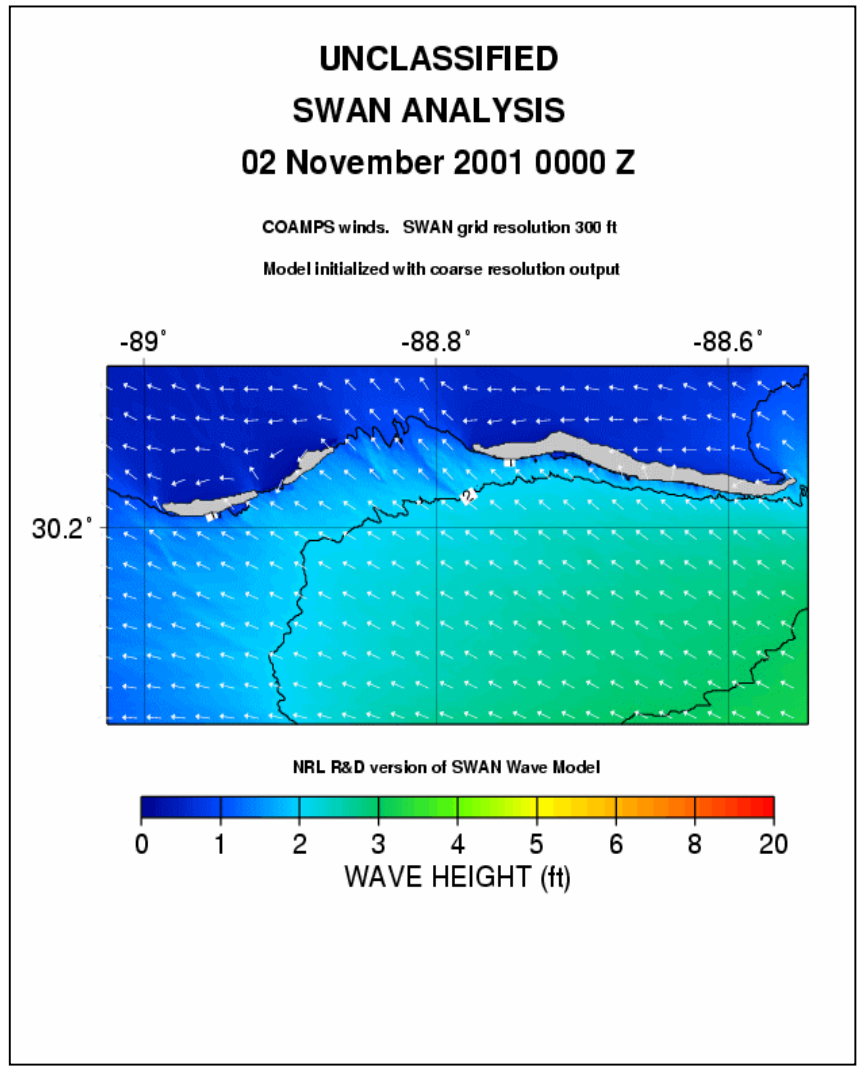
ROAMER/ DIOPS

Example during the NAVO AUV Fest 2001

SURF ZONE

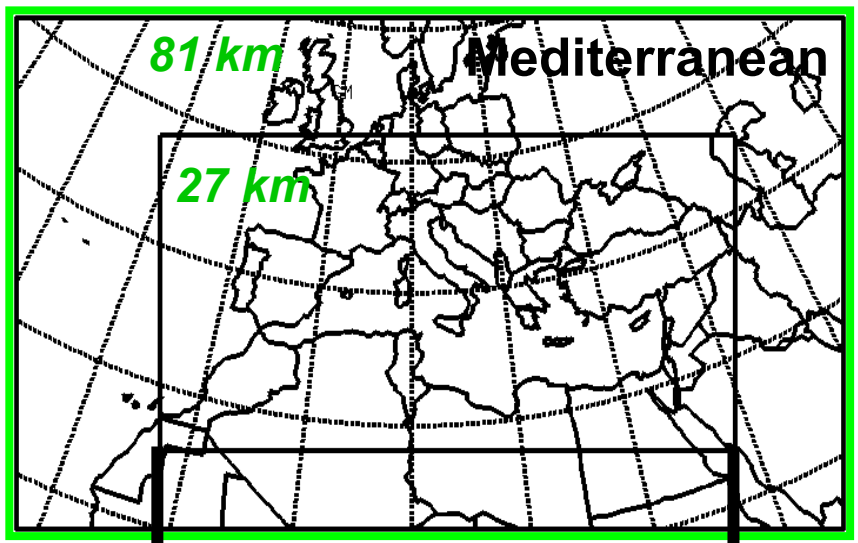


WAVE HEIGHTS/DIR

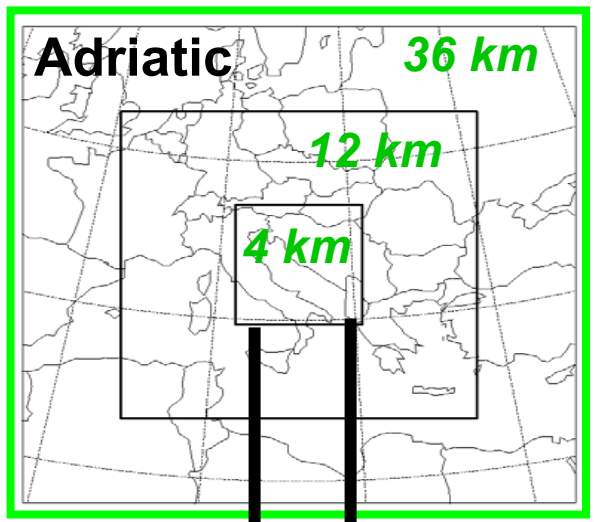


Coupled Modeling

Mediterranean Example (Courtesy: J. Pullen, NRLMRY)

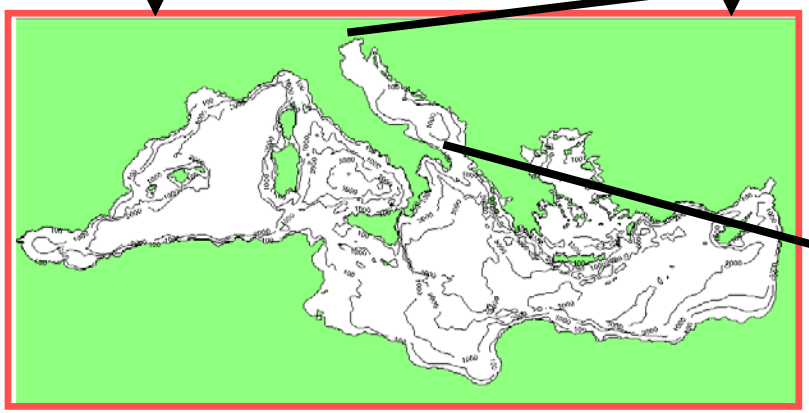


COAMPS



(momentum + heat fluxes)

(momentum + heat fluxes)

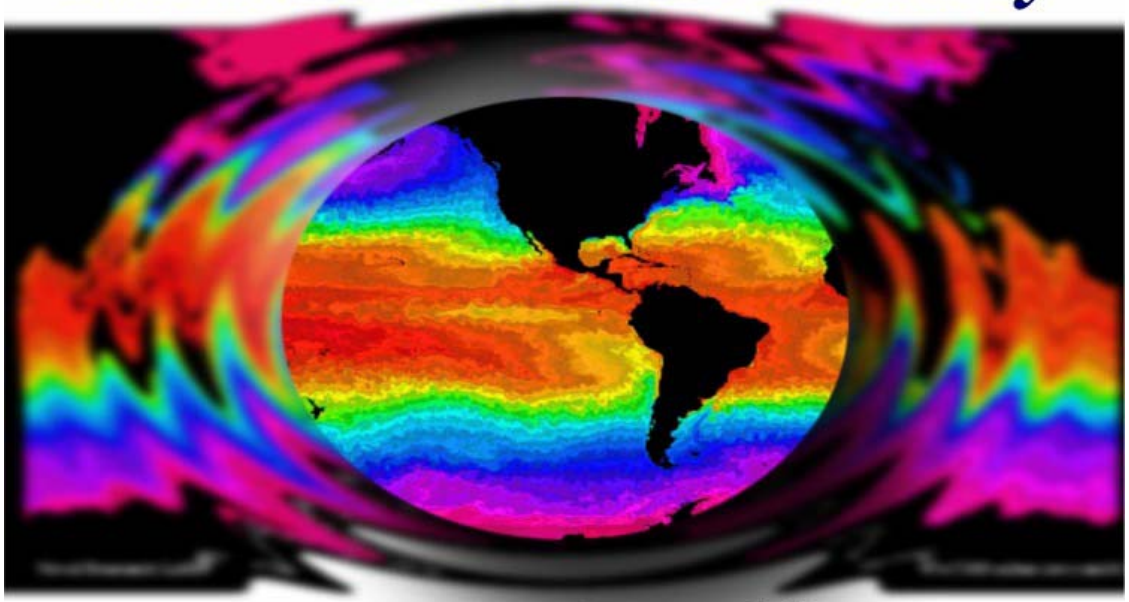


NCOM
6 km

NCOM
2 km

nested

Naval Research Laboratory



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http://www.ocean.nrlssc.navy.mil

Ocean Prediction Capabilities (Present & Future) at the Naval Research Laboratory

J. Harding[1], R. Preller, R. Rhodes

Presented at: MTS/IEEE OCEANS 2002, October 2002

[1]Present Affiliation: Naval Oceanographic Office